

State of Hawaii  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
Division of Aquatic Resources  
Honolulu, Hawaii 96813

April 19, 2010

Board of Land and Natural Resources  
State of Hawaii  
Honolulu, Hawaii

Resubmittal of Request for Authorization and Approval to Issue a Papahānaumokuākea Marine National Monument Research Permit to Dr. Greta Aeby, University of Hawaii, Hawaii Institute of Marine Biology, for Access to State Waters to Conduct Coral and Fish Disease

Research Activities

***(Submittal was deferred at the 4/8/2010 BLNR meeting, but has been withdrawn at the request of the Applicant.)***

*The Board may go into Executive Session pursuant to Section 92-5(a)(4), Hawaii Revised Statutes, in order to consult with its attorney on questions and issues pertaining to the Board's powers, duties, privileges, immunities and liabilities.*

The Division of Aquatic Resources (DAR) hereby submits a request for your authorization and approval for issuance of a Papahānaumokuākea Marine National Monument research permit to Dr. Greta Aeby, assistant researcher, University of Hawaii, Hawaii Institute of Marine Biology, pursuant to § 187A-6, Hawaii Revised Statutes (HRS), chapter 13-60.5, Hawaii Administrative Rules (HAR), and all other applicable laws and regulations.

The research permit, as described below, would allow entry and research activities to occur in Papahānaumokuākea Marine National Monument (Monument), including the NWHI State Marine Refuge and the waters (0-3 nautical miles) surrounding the following sites:

- French Frigate Shoals
- Gardner Pinnacles
- Maro Reef
- Laysan Island
- Lisianski Island, Neva Shoal
- Pearl and Hermes Atoll
- Kure Atoll State Seabird Sanctuary

The activities covered under this permit would occur between May 1, 2010 and September 30, 2010.

The Department has made an exemption determination for this permit in accordance with chapter 343, HRS and Chapter 11-200, HAR. See Attachment ("DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR PAPAHA NAUMOKU AKEA MARINE NATIONAL MONUMENT

RESEARCH PERMIT TO DR. GRETA AEBY, UNIVERSITY OF HAWAII, HAWAII INSTITUTE OF MARINE BIOLOGY, FOR ACCESS TO STATE WATERS TO CONDUCT CORAL AND FISH DISEASE RESEARCH ACTIVITIES UNDER PERMIT PMNM-2010-018”).

The proposed activities are largely a renewal of work previously permitted in the Monument.

#### INTENDED ACTIVITIES:

The purpose of these activities is to examine coral and fish disease occurring within the Monument.

##### Coral disease

The objectives of the activities are to

- determine the incidence (change in disease levels through time) of coral disease at several sites within the Monument;
- determine whether growth anomalies affect the growth of table corals
- determine whether removal of growth anomalies (GAs) off of table corals enhances growth or reproduction of affected colonies

To conduct this research, the applicant would survey reefs for coral disease, mark and photograph individual colonies exhibiting signs of disease, repair permanent sites, and surgically remove growth anomalies off of corals to determine the efficacy of this method for managing this disease.

##### *Disease surveys*

Re-survey of established sites throughout the Monument would follow established protocol. Transect lines would be laid out along the permanent pins. Corals along the lines would be identified to species, counted, and assigned to a size class. In addition, divers would examine all corals for signs of bleaching or disease. For corals exhibiting disease, a general description of the condition would be recorded, the coral would be photographed and a specimen would be collected for histopathological examination. Colonies tagged in 2005 or 2006 would be relocated, remarked and photographed. Any new infected colonies along the transect would be photographed and tagged. Any lost pins would be replaced.

The Applicant requests to only collect samples of diseased corals that have not already been characterized by histology. She anticipates a maximum of 30 samples (all islands combined) to be collected if new diseases are encountered. Sample sizes would be 2-5 cm each. 2 samples would be taken per colony (one from the diseased region and one from the healthy region).

##### *Growth studies and tumor removal*

Colonies of *Acropora cytherea* with growth anomalies and a nearest neighbor of similar size would be measured, photographed and tagged. They would be re-examined the following year (2011) to look for differences in growth between affected and control colonies.

Ten *Acropora* colonies with growth anomalies and five healthy nearest neighbor colonies would be surveyed as described above. Growth anomalies would be removed from five of the colonies.

GAs would be bagged at depth and processed onboard the ship for further study. In addition, to determine whether growth anomaly removal might also enhance reproduction of the colonies a small sample (5-7cm) would be collected off of all colonies (5 healthy, 5 control GA, 5 treated GA). All colonies would be re-surveyed and sampled the following year to determine effect of the treatment on the growth and reproduction of colonies.

#### Fish disease

The objectives of the activities are to

- determine distribution and prevalence of fish disease
- determine the affect of disease on the body condition of fish
- determine the distribution and prevalence of parasitic diseases in zooplankton

#### *Fish surveys*

Visual surveys of populations of surgeonfish and butterflyfish will be conducted at all islands visited. Census techniques will consist of linear timed swims (using SCUBA) of 45-60 min where all acanthurids and chaetodontids with and without skin lesions or tumors will be enumerated. The methods proposed are the same as those used to document prevalence of fish disease within the MHI.

#### *Histology*

Fish with noticeable lesions would be collected by spear, placed on ice and transported to the ship for examination. Fish will be weighed and measured, examined systematically externally and internally, and gross lesions documented. For histopathology, sections of various internal parts would be excised and fixed in 10% neutral buffered formalin. Histopathology allows one to characterize microscopic morphology of disease, provide systematic evaluation of cellular changes that occur in disease, and afford the opportunity to detect microorganisms and the host response to these organisms.

The applicant is requesting to collect a maximum of 20 fish per specie per island for ta'ape and the five goatfish species. For affected surgeonfish, she is requesting a maximum of 10 affected and 10 healthy fish per specie per island.

#### *Zooplankton surveys*

Zooplankton would be collected, opportunistically, by plankton tows and/or light traps. All samples would be preserved in 10% formalin and transported back to a lab in Honolulu. Samples would be sorted and screened for parasitic infections.

The activities proposed by the applicant directly support the Monument Management Plan's priority management needs 3.1 – Understanding and Interpreting the NWHI (through action plan 3.1.1 – Marine Conservation Science).

The activities described above may require the following regulated activities to occur in State waters:

- ☒ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving monument resource

- ☒ Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands
- ☒ Touching coral, living or dead
- ☒ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
- ☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

### REVIEW PROCESS:

The permit application was sent out for review and comment to the following scientific and cultural entities: Hawaii Division of Aquatic Resources, Hawaii Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). In addition, the permit application has been posted on the Monument Web site since March 15th, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy.

### **Comments received from the scientific community are summarized as follows:**

Scientific reviews support the acceptance of this application.

#### Concerns raised:

1. Butterfly fish and surgeonfish aren't listed in the specimen collection section. What fish are actually being studied?
2. Are any contaminant analyses occurring to see if this is influencing disease occurrence?
3. What is the impact of the nematode on corals and the relationship to the disease being studied?
4. Please provide further details of the light trap. What is the trap, how will it be deployed and recovered, when and where will deployments take place? What will be done with the water samples/zooplankton upon collection?

### **Comments received from the Native Hawaiian community are summarized as follows:**

Cultural reviews support the acceptance of this application.

#### Concerns raised

5. What are the cultural implications and impacts of this project? Applicant needs to address cultural components of question 7 in the application.

**Comments received from the public are summarized as follows:**

No comments were received from the public on this application.

**Additional reviews and permit history:**

Are there other relevant/necessary permits or environmental reviews that have or will be issued with regard to this project? (e.g. MMPA, ESA, EA) Yes ☒ No ☐

If so, please list or explain:

- The proposed activities are in compliance with the National Environmental Policy Act.
- The proposed activities are in compliance with HRS Chapter 343 (exemption class HAR §11-200-8(a)(5)).

Has Applicant been granted a permit from the State in the past? Yes ☒ No ☐

If so, please summarize past permits:

- The applicant was granted permit DLNR/NWHI/06R008 to conduct similar work in 2009.
- In addition, joint Monument permit PMNM-2008-036 was issued to Dr. Fenny Cox for similar work in 2008, but the activities were never carried out.

Have there been any a) violations: Yes ☒ No ☐  
b) Late/incomplete post-activity reports: Yes ☐ No ☒

Are there any other relevant concerns from previous permits? Yes ☐ No ☒

- The 2006 state permit, referenced above, resulted in a violation against Greta Aeby.

**RESPONSE:**

1. The Applicant explains that butterflyfish and surgeonfish are being visually surveyed for skin disease. Taape and goatfish are being collected to examine the introduced intestinal parasitic nematode.
2. The Applicant states that no such analyses are occurring at this time but acknowledges that it would be a good thing to look at in the future, especially at FFS.
3. The Applicant explains that ecosystem management is what is requested up in the NWHI, so her lab is expanding its' studies beyond just the corals to the other inhabitants of the ecosystem including the fish and the zooplankton. She states that this

will start to provide health information about the ecosystem from three different trophic levels, and that all organisms within the ecosystem are ultimately linked. The information gained from examining the spread of the parasitic nematode up into the NWHI from the main Hawaiian Islands will also give an idea of connectivity of the islands in an ecologically relevant time frame.

4. The Applicant explains that the light trap is essentially a waterproof light bulb put into the water to attract zooplankton. A bucket is lowered into the water under the light and the water and zooplankton are scooped up. The zooplankton would be separated out of the water and preserved in 4% formalin or 95% ethanol. This activity would only occur if the ship decides it is feasible.
5. The Applicant states that the Hawaiian people have long lived off of the bounty from the sea. To continue this heritage requires the maintenance of the coral reef ecosystem under changing climatic conditions. This project is designed to preserve the coral reef resources of the NWHI. Corals are the very foundation of the ecosystem and if they are killed off by disease then the entire ecosystem will collapse.

#### STAFF OPINION:

DAR staff is of the opinion that Applicant should be denied her request for a permit. This opinion is based on Hawaii Administrative Rule Chapter 13-60.5, section 6(a)(3), which states "The Board shall deny an application based on a past violation or non-compliance with any term or condition of a permit issued under this chapter;". DAR staff is also of the opinion that the Department should seek clarification of the rules as they pertain to permitting.

#### MONUMENT MANAGEMENT BOARD OPINION:

The MMB is of the opinion that the Applicant has met nine of the ten findings of Presidential Proclamation 8031. Whether the Applicant has met the 10<sup>th</sup> finding ("There are no other factors that would make the issuance of a permit for the activity inappropriate") is a policy determination that remains to be made before the permit is issued. The federal MMB representatives understand that the Applicant has a previous violation in state waters. Additionally, they recognize that there is a state administrative rule related to violations and the issuance of permits. Therefore, the federal representatives recognize the BLNR's role in determining how to apply the rule in this instance. OHA supports the research proposed in this application. If all findings are met, the MMB is of the opinion that this activity may be conducted. However, due to concerns over Dr. Aeby's previous permit violation, it is recommended that she act in a limited capacity. The MMB suggests the following restrictions and oversights to Dr. Aeby's participation on permit PMNM-2010-018:

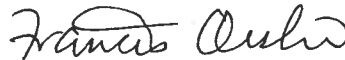
1. Dr. Aeby be permitted to snorkel, but not SCUBA dive. Her assistance in locating survey sites can be accomplished from the surface.
2. Dr. Aeby not be permitted to handle or process samples.

3. A Monument employee shall be present on the cruise to oversee activities conducted under permit PMNM-2010-018.

RECOMMENDATION:

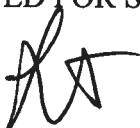
That the Board deny this request for issuance of a Research Permit to Dr. Greta Aeby, University of Hawaii, Hawaii Institute of Marine Biology, based on the current interpretation of Hawaii Administrative Rule Chapter 13-60.5, section 6(a)(3), and that the Department seek clarification of the rules as they pertain to permitting.

Respectfully submitted,



 Administrator

APPROVED FOR SUBMITTAL



LAURA H. THIELEN  
Chairperson

Attachment

LINDA LINGLE  
GOVERNOR OF HAWAII



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
DIVISION OF AQUATIC RESOURCES  
1151 PUNCHBOWL STREET, ROOM 330  
HONOLULU, HAWAII 96813

LAURA H. THIELEN  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT

KEN C. KAWAHARA  
DEPUTY DIRECTOR - WATER

RUSSELL TSUJI  
DEPUTY DIRECTOR-LAND

AQUATIC RESOURCES  
BOATING AND OCEAN RECREATION  
BUREAU OF CONVEYANCES  
COMMISSION ON WATER RESOURCE MANAGEMENT  
CONSERVATION AND COASTAL LANDS  
CONSERVATION AND RESOURCES ENFORCEMENT  
ENGINEERING  
FORESTRY AND WILDLIFE  
HISTORIC PRESERVATION  
KAHOOLAWE ISLAND RESERVE COMMISSION  
LAND  
STATE PARKS

April 6, 2010

TO: Division of Aquatic Resources File

THROUGH: Laura H. Thielen, Chairperson

FROM: Francis Oishi, Program Manager *FO*  
Division of Aquatic Resources

SUBJECT:

DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT  
UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR  
PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO DR. GRETA AEBY,  
UNIVERSITY OF HAWAII, HAWAII INSTITUTE OF MARINE BIOLOGY, FOR ACCESS TO STATE WATERS  
TO CONDUCT CORAL AND FISH DISEASE RESEARCH ACTIVITIES  
UNDER PERMIT PMNM-2010-018.

The following permitted activities are found to be exempted from preparation of an environmental assessment under the authority of Chapter 343, HRS and Chapter 11-200, HAR:

Project Title:

Papahānaumokuākea Marine National Monument Research Permit to Dr. Greta Aeby, University of Hawaii, Hawaii Institute of Marine Biology, for Access to State Waters to Conduct Coral and Fish Disease Research Activities.

Permit Number: PMNM-2010-018.

Project Description:

The research permit, as described below, would allow entry and activities to occur in Papahānaumokuākea Marine National Monument (Monument), including state waters, from May 1, 2010 through September 30, 2010.

This permit is intended to cover all activities necessary to examine coral and fish disease occurring within the Monument. The scope of activities in the permit include conducting visual surveys of corals and fish, removing target coral disease growths, and collecting target corals, fish, and zooplankton. The permittee anticipates a maximum of 30 coral samples to be collected if new diseases are encountered. Permittee would also collect up to 20 fish per species per island.

The proposed activities are in direct support of the Monument Management Plan's priority management needs 3.1 – Understanding and Interpreting the NWHI (through action plan 3.1.1 –



April 6, 2010

Marine Conservation Science). This action plan specifies to "monitor shallow-water coral reef ecosystems to protect ecological integrity." Activities to support understanding of marine ecosystems, which could include monitoring of diseased coral and fish, are addressed in the EA. This EA summarizes that understanding how populations change could be helpful to forecast, prepare for and mediate potential threats to populations within the Monument (PMNM MMP Vol 2, p.171). Disease monitoring and removal studies, such as those proposed, would enhance this understanding.

Consulted Parties:

The permit application was sent out for review and comment to the following scientific and cultural entities: Hawaii Division of Aquatic Resources, Hawaii Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). The Principal Investigator for this project, Greta Aeby, has also been consulted with respect to her experience in successfully conducting studies on coral and fish diseases. In addition, the permit application has been posted on the Monument Web site since March 15th, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy.

Exemption Determination:

After reviewing HAR § 11-200-8, including the criteria used to determine significance under HAR § 11-200-12, DLNR has concluded that the activities under this permit would have minimal or no significant effect on the environment and that issuance of the permit is categorically exempt from the requirement to prepare an environmental assessment based on the following analysis:

1. All activities associated with this permit, including the collection of fish and coral samples have been evaluated as a single action. As a preliminary matter, multiple or phased actions, such as when a group of actions are part of a larger undertaking, or when an individual project is precedent to or represents a commitment to a larger project, must be grouped together and evaluated as a single action. HAR § 11-200-7. Since this permit involves an activity that is precedent to a later planned activity, i.e. the re-survey and sampling of target corals and fish, the categorical exemption determination here will treat all planned activities as a single action.

2. The Exemption Class for Scientific Research with no Serious or Major Environmental Disturbance Appears to Apply. Chapter 343, HRS, and § 11-200-8, HAR, provide for a list of classes of actions exempt from environmental assessment requirements. HAR §11-200-8.A.5. specifically exempts the class of actions which involve "basic data collection, research, experimental management, and resource evaluation activities, which do not result in a serious or major disturbance to an environmental resource." This exemption class has been interpreted to include research related to the development and management of various aquatic organisms such as those being proposed. Accordingly Exemption Class #5, Exempt Items #4 and #5, the former Division of Fish and Game established its own published list of exempted activities types under this exemption class, including "wildlife and game surveys, censuses, inventories, studies . . . collection and captive propagation," as well as the "research activities involving fish transects, [and] occasional fish collection for study and observation." DEPARTMENT OF LAND & NATURAL RESOURCES, EXEMPTION LIST FOR THE DIVISION OF FISH AND GAME 3-4 (January 19, 1976).

The proposed coral and fish health study appears to fall squarely under the exemption class identified under HAR § 11-200-8.A.5., and are succinctly described under the former Fish and Game Division exemption list published in 1976, as involving surveys of aquatic animals and experimental management. As discussed below, no significant disturbance to any environmental resource is anticipated in either the surveys of corals and fish, removing target coral disease growths, or collecting target corals, fish, and zooplankton. Thus, so long as the below considerations are met, an exemption class should include the action now contemplated.

3. Cumulative Impacts of Actions in the Same Place and Impacts with Respect to the Potentially Particularly Sensitive Environment Will Not be Significant. Even where a categorical exemption appears to include a proposed action, the action cannot be declared exempt if “the cumulative impact of planned successive actions in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment.” HAR § 11-200-8.B. To gauge whether a significant impact or effect is probable, an exempting agency must consider every phase of a proposed action, any expected primary and secondary consequences, the long-term and short-term effects of the action, the overall and cumulative effect of the action, and the sum effects of an action on the quality of the environment. HAR § 11-200-12. Examples of actions which commonly have a significant effect on the environment are listed under HAR § 11-200-12.

A limited number of studies of this type have been undertaken to date and include only an initial survey of coral disease at permanent sites (Aeby 2005) with one follow-up survey which documented the spread and severity of a coral disease outbreak (Aeby 2006). A limited number of fish (taape and goatfish) have been collected for genetic and disease studies and no zooplankton studies have yet been undertaken in the Northwestern Hawaiian Islands. Removal of diseased corals and fishes as well as removal of introduced fishes could be considered a beneficial effect to the environment. With this in mind, significant cumulative impacts are not anticipated as a result of this activity, and numerous safeguards further ensure that the potentially sensitive environment of the project area will not be significantly affected. All activities will be conducted in a manner compatible with the management direction of the Monument Proclamation in that the activities do not diminish monument resources, qualities, and ecological integrity, or have any indirect, secondary, cultural, or cumulative effects. The joint permit review process did not reveal any anticipated indirect or cumulative impacts, nor did it raise any cultural concerns, that would occur as a result of these activities.

Since no significant cumulative impacts or significant impacts with respect to any particularly sensitive aspect of the project area are anticipated, the categorical exemptions identified above should remain applicable.

4. Overall Impacts will Probably be Minimal and Insignificant. Any foreseeable impacts from the proposed activity will probably be minimal, and further mitigated by general and specific conditions attached to the permit. Specifically, all research activities covered by this permit will be carried out with strict safeguards for the natural, historic, and cultural resources of the Monument as required by Presidential Proclamation 8031, other applicable law and agency policies and standard operating procedures. This project is an important continuation of prior projects which had been subjected to the public review process. Visual coral and fish surveys are non-invasive by nature and zooplankton are microscopic animals found by the billions in seawater. The small number of fish samples requested are negligible and include an introduced fish species (taape) which can negatively affect native fish populations.

April 6, 2010

Conclusion. Upon consideration of the permit to be approved by the Board of Land and Natural Resources, the potential effects of the above listed project as provided by Chapter 343, HRS and Chapter 11-200 HAR, have been determined to be of probable minimal or no significant effect on the environment and exempt from the preparation of an environmental assessment.

---

Laura H. Thielen  
Chairperson, Board of Land and Natural Resources

---

Date

**Papahānaumokuākea Marine National Monument**  
RESEARCH Permit Application

**NOTE: *This Permit Application (and associated Instructions) are to propose activities to be conducted in the Papahānaumokuākea Marine National Monument. The Co-Trustees are required to determine that issuing the requested permit is compatible with the findings of Presidential Proclamation 8031. Within this Application, provide all information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Papahānaumokuākea Marine National Monument (Monument).***

**ADDITIONAL IMPORTANT INFORMATION:**

- Any or all of the information within this application may be posted to the Monument website informing the public on projects proposed to occur in the Monument.
- In addition to the permit application, the Applicant must either download the Monument Compliance Information Sheet from the Monument website OR request a hard copy from the Monument Permit Coordinator (contact information below). The Monument Compliance Information Sheet must be submitted to the Monument Permit Coordinator after initial application consultation.
- Issuance of a Monument permit is dependent upon the completion and review of the application and Compliance Information Sheet.

**INCOMPLETE APPLICATIONS WILL NOT BE CONSIDERED**

Send Permit Applications to:

Papahānaumokuākea Marine National Monument Permit Coordinator

6600 Kalaniana'ole Hwy. # 300

Honolulu, HI 96825

[nwhipermmit@noaa.gov](mailto:nwhipermmit@noaa.gov)

PHONE: (808) 397-2660      FAX: (808) 397-2662

**SUBMITTAL VIA ELECTRONIC MAIL IS PREFERRED BUT NOT REQUIRED. FOR  
ADDITIONAL SUBMITTAL INSTRUCTIONS, SEE THE LAST PAGE.**

## **Papahānaumokuākea Marine National Monument Permit Application Cover Sheet**

This Permit Application Cover Sheet is intended to provide summary information and status to the public on permit applications for activities proposed to be conducted in the Papahānaumokuākea Marine National Monument. While a permit application has been received, it has not been fully reviewed nor approved by the Monument Management Board to date. The Monument permit process also ensures that all environmental reviews are conducted prior to the issuance of a Monument permit.

### **Summary Information**

**Applicant Name:** Greta Smith Aeby

**Affiliation:** HIMB

**Permit Category:** Research

**Proposed Activity Dates:** May 1 - Sept 30, 2010

**Proposed Method of Entry (Vessel/Plane):** NOAA research vessel Hiialakai

**Proposed Locations:** shallow water reefs throughout the Monument

**Estimated number of individuals (including Applicant) to be covered under this permit:**

2

**Estimated number of days in the Monument:** 21-28 days

**Description of proposed activities:** (complete these sentences):

a.) The proposed activity would...

Determine the incidence of coral disease at several sites within the Monument and test a method for managing damage from Acropora growth anomalies. Fish (surgeonfish and butterflyfish) with skin cancer would be surveyed to determine distribution and prevalence of the disease in fish populations. Determine the effect of skin cancer on the body condition of fish. Baseline studies on the parasites of zooplankton will be initiated.

b.) To accomplish this activity we would ....

Survey reefs for coral disease, mark and photograph individual colonies exhibiting signs of disease, repair permanent sites, surgically remove growth anomalies off of table corals to determine efficacy of this method for managing disease. Surgeonfish and butterflyfish populations will be surveyed. Surgeonfish with skin cancer would be collected to examine the effect of the disease on the body condition of the fish. Plankton tows and light traps will be used to collect zooplankton at the different islands to be screened for parasite infections.

c.) This activity would help the Monument by ...

giving them information as to the health status of their reefs, ability to predict damage from coral disease through time, and a potential method to control *Acropora* growth anomalies. Studies of fish disease will give them information on how widespread cancer is in fish population within the Monument.

**Other information or background:** Global climate change and human activities are placing coral reef ecosystems at risk. Coral reefs worldwide are now declining at an alarming rate. Mass bleaching events have increased dramatically since the 1980's and have usually been linked to El Niño or global warming-related increases in annual sea surface temperature (Brown 1997, Barber et al. 2001). The El Niño Southern Oscillation (ENSO) conditions during 1997 to 1998 resulted in worldwide bleaching from the Western Atlantic to the Great Barrier Reef. ENSO events have increased in frequency and duration in the past two decades (Barber et al. 2001, Walker 2001) and it has been predicted that the frequency and severity of coral bleaching will also continue to rise (Hoegh-Guldberg 1999).

Disease in coral reef ecosystems has received great attention, particularly in the western Atlantic where coral disease has been incriminated in the marked degradation of reef habitats. (Santavy and Peters 1997, Green and Bruckner 2000). Coral disease is reported to be responsible for the dramatic decline of *Acroporids*, one of the major frame-building corals in the Florida Keys, changing the structure and function of the coral reef ecosystem (Aronson & Precht 2001). Despite the major impact disease can have on reef systems, the etiology of most coral diseases remains unclear (Santavy and Peters 1997, Richardson 1998). The causative agents, mechanism of pathogenesis and link to environmental or anthropogenic stress are still largely unknown (Richardson 1998, Green & Bruckner 2000).

The reefs of the Northwestern Hawaiian Islands (NWHI) are considered to be relatively healthy but they are not immune to the conditions that have led to the decline of other reef systems. In September 2002 the first mass-bleaching event was recorded on the reefs of the NWHI with a second bleaching event occurring in 2004. In the three northwestern most atolls of the Archipelago (Pearl & Hermes, Midway and Kure) over half of all sites had significant bleaching (Aeby et al. 2003, Kenyon et al., 2005). Ten coral disease states have now been described from the NWHI (Aeby 2006) and we have established permanent sites which allow us to determine both temporal and spatial changes in diseases through time and the ultimate affect of disease on the health of the ecosystem. We will measure changes in disease levels through time, rates of tissue loss from different diseases, patterns of disease transmission among colonies, rate of spread of disease and evaluate changes in coral cover and coral species composition. In addition, two diseases of concern have been identified, *Acropora* white syndrome and *Acropora* growth anomalies which we are targeting for focused studies.

*Acropora* white syndrome (AWS) is a disease which causes acute tissue loss in *acroporids* and has been reported from across the Indo-Pacific. *Acropora* white syndrome appeared on one reef in the northwestern Hawaiian Islands (NWHI) in 2003 (Aeby 2006) and has since spread. Our prior studies in 2005 and 2006 found this disease to be highly virulent having killed over 19 large table *acroporids* with numerous other colonies suffering massive tissue loss from the disease. The disease occurs predominantly at French Frigate Shoals (FFS) within the NWHI, which is the center of abundance and diversity of *acroporids* in Hawaii. We plan to continue to follow the dynamics of this disease by re-surveying permanent sites to measure coral mortality and disease spread.

Disease can affect coral communities directly through mortality of colonies (partial or whole) resulting in reduced coral cover (such as we found for AWS) or indirectly through sub-lethal events such as reduced growth, resilience or reproduction. From our 2006 study we discovered that *Acropora cytherea* with growth anomalies suffer a significant reduction in reproductive output. We would now like to determine whether this disease also affects the growth of colonies and whether removal of growth anomalies could be an effective management tool. During our prior studies we documented the occurrence of "dead zones" within "tumor city" at one of our permanent sites. This suggest that this disease is slowing killing corals through time. By tagging individual affected colonies for growth studies we will also be able to determine the lethality of this disease through time.

Diseases in marine ecosystems are not only limited to corals. Fibropapillomatosis of green turtles has been known in Hawaii since the 1950s (Balaz 1991). More recently, high levels of infections with bacteria and protozoa have been seen in *taape* (*Lutjanus kasmira*) (Work et al. 2003). *Taape* were introduced into Hawaii in the 1950s (Randall 1987) and have spread all the way to Midway Atoll. *Taape* are closely associated with certain native fish such as goatfish (*Mulloidichthys* sp.) (Friedlander et al. 2002) and goatfish from the main Hawaiian Islands have been found to be infected with some of the same diseases as *taape* (Work et al. unpub. data). Given that *taape* were introduced into Hawaii, there is the concern that the recently documented diseases may have been introduced with them from the Marquesas. *Taape* are infected with a parasitic gut nematode that is thought to have been brought into the Hawaiian ecosystem with the introduction of the fish. This nematode infection has also been found in co-occurring native goatfish species. *Taape* were originally introduced into Oahu and have recruited out to other islands and up into the NWHI. The question now arises as to whether disease transmission has occurred from the main HI out to the NWHI.

From our 2006 study we found that *taape* from FFS had the nematode infection yet this disease was not found in fish from Midway. It appears that there is a lag in the time required for *taape* to establish in the NWHI as compared to the establishment of fish disease. The spread of both *taape* and its diseases up into the NWHI may be reflective of real time ecological linkages between islands within the Hawaiian archipelago. We have a rough timeline of the spread of *taape* from Oahu out to Midway and could correlate that with the eventual emergence of this disease at Midway. From studies in 2006, we also found that species of native goatfishes from FFS also have the nematode infection. We would like to also sample goatfishes from the other islands we are visiting to determine whether the pattern of disease is similar to that found in *taape*.

Based upon studies of similar nematodes, we hypothesized that the first intermediate host of the potentially introduced parasitic red nematode is a planktonic copepod which could be the mechanism of disease dispersal throughout the Hawaiian Islands. Preliminary work at our lab in Honolulu has potentially identified the copepod hosts species as *Lobidocera madurae* and *Undinula vulgaris*. During this study we also found that the zooplankton in Kaneohe Bay contained a variety of different larval parasites. Parasites transmitted through the foodchain, such as these within the copepods, are useful as potential indicators of ecosystem health. Parasites can only remain in host populations if all hosts within the life cycle are present and in sufficient numbers to maintain the disease. Hence, healthy ecosystems may have higher levels of certain types of parasites as compared to more degraded regions where host abundance is reduced. We would now to compare the parasite levels of the zooplankton within the NWHI with our finding

within the MHI and explore whether there is evidence that copepods infected with the larval stage of the red nematode may be the mechanism of disease spread within the Hawaiian Archipelago.

From our 2005 and 2006 studies we found that the surgeonfish, *Ctenochaetus strigosus*, (kole) with a pigment discoloration had pathology consistent with cancerous lesions. Further survey work within the MHI found diseased kole on Oahu, Maui, Kauai and Molokai. We also observed several other species of surgeonfish with similar patterns of discoloration. Using the same survey method used in the MHI we would now like to compare distribution and prevalence of diseased fish in the NWHI.

It is important for management agencies to have a through understanding of the vulnerability of these reefs to disease and the first steps in managing disease are developing an understanding of the causes of disease and assessing its geographic extent. Management of disease in wildlife populations usually involves either reducing or removing the source of infection or reducing the spread of the disease. However, before appropriate management plans can be made the epizootiology of diseases must be understood. Our studies, past and proposed, are supplying critical information into disease dynamics in both coral and fish within the NWHI.



## **Section A - Applicant Information**

### **1. Applicant**

Name (last, first, middle initial): Aeby, Greta S.

Title: assistant researcher

#### **1a. Intended field Principal Investigator (See instructions for more information):**

Dr. Greta Aeby

#### **2. Mailing address (street/P.O. box, city, state, country, zip):**

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

For students, major professor's name, telephone and email address:

#### **3. Affiliation (institution/agency/organization directly related to the proposed project):**

Hawaii Institute of Marine Biology

#### **4. Additional persons to be covered by permit. List all personnel roles and names (if known at time of application) here (e.g. John Doe, Research Diver; Jane Doe, Field Technician):**

Dr. Fenny Cox: co-investigator

Dr. Frank Stanton: co-investigator



## **Section B: Project Information**

### **5a. Project location(s):**

<input type="checkbox"/> Nihoa Island	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Necker Island (Mokumanamana)	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> French Frigate Shoals	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Gardner Pinnacles	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Maro Reef			
<input checked="" type="checkbox"/> Laysan Island	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Lisianski Island, Neva Shoal	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Pearl and Hermes Atoll	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Midway Atoll	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Kure Atoll	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Other			

### **Ocean Based**

NOTE: There is a fee schedule for people visiting Midway Atoll National Wildlife Refuge via vessel and aircraft.

### **Location Description:**

shallow reefs throughout the Monument

### **5b. Check all applicable regulated activities proposed to be conducted in the Monument:**

- ☒ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource
- ☒ Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands
- ☒ Anchoring a vessel
- ☐ Deserting a vessel aground, at anchor, or adrift
- ☐ Discharging or depositing any material or matter into the Monument
- ☒ Touching coral, living or dead
- ☒ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
- ☐ Attracting any living Monument resource
- ☐ Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)
- ☐ Subsistence fishing (State waters only)
- ☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

**6 Purpose/Need/Scope *State purpose of proposed activities:***

1. To re-survey permanent sites established in 2005 for assessment of disease dynamics
2. To determine whether growth anomalies affect the growth of table corals
3. To determine whether removal of growth anomalies off of table corals will enhance the growth or reproduction of affected colonies
4. To determine distribution and prevalence of fish disease
5. To determine the affect of skin cancer on the body condition of fish
6. To determine distribution and prevalence of parasitic diseases in zooplankton

**7. Answer the Findings below by providing information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Monument:**

The Findings are as follows:

- a. How can the activity be conducted with adequate safeguards for the cultural, natural and historic resources and ecological integrity of the Monument?

Activities will be conducted in a manner to minimally impact coral reef resources and standard protocols for disease studies developed for the Monument will be used. All gear will be sterilized each day and any collected organisms will be placed in plastic bags at depth before transfer to the small boat. All laboratory work will be conducted using established biosecure protocols including sterilizing all tools and work surfaces. All biological samples will be fixed in solution for transport to our laboratories in Honolulu.

- b. How will the activity be conducted in a manner compatible with the management direction of this proclamation, considering the extent to which the conduct of the activity may diminish or enhance Monument cultural, natural and historic resources, qualities, and ecological integrity, any indirect, secondary, or cumulative effects of the activity, and the duration of such effects?

The collapse of coral reefs from disease in other regions points to the critical need to understand disease processes. Our research program is dedicated to studying disease in the Monument so that managers have the information they need to protect these vulnerable resources. All research proposed in this permit application is directly

applicable to the management of diseases of coral and fish within the region. All surveys are conducted in a manner causing little to no impact on the environment as they use visual and photographic techniques. We will be collecting the minimal number of fish or coral samples required to complete our laboratory analyses.

c. Is there a practicable alternative to conducting the activity within the Monument? If not, explain why your activities must be conducted in the Monument.

There is no alternative to conducting the activity in the Monument. Although, comparative studies of disease in other regions are useful, they cannot replace understanding damage from the specific diseases affecting fish and coral populations in the Monument.

d. How does the end value of the activity outweigh its adverse impacts on Monument cultural, natural and historic resources, qualities, and ecological integrity?

If diseases are not managed in the Monument, the coral reefs will suffer the same fate as coral reefs in the Florida Keys and other regions of the Caribbean. In the Keys, their acroporids, which used to be their numerically dominant coral, have been reduced by 90% and are now on the endangered species list (Patterson et al. 2002). Acroporids in the Monument are already in decline due to two different diseases, Acropora white syndrome and Acropora growth anomalies. Current models of global climate change predict a significant increase in sea surface temperature (Kleypas et al. 1999). Elevated temperatures have been shown to accelerate the growth rate and pathogenicity of pathogens and so it is predicted coral disease will become more common and widespread (Porter et al. 2001). On the GBR, increases in White Syndrome are associated with temperature anomalies. Acropora white syndrome is also currently killing corals in the Monument so information of the epizootiology of this disease is critically important for the development of both immediate and long-term management strategies. Reductions in fish populations from overfishing has contributed to the decline of reefs as algae are allowed to outcompete corals. The Monument is closed to fishing but its fish populations are known to suffer from diseases. Kole (*Acanthurus strigosus*), an important herbivore, was found to have skin cancer. However, nothing is known about the distribution or prevalence of this disease in fish populations. Our studies on

coral and fish diseases provide critical information necessary for management to address the already established disease outbreaks degrading the coral reefs of the Monument.

e. Explain how the duration of the activity is no longer than necessary to achieve its stated purpose.

We are requesting the absolute minimum amount of time require to condut our studies.

We anticipate staying a maximun of 5 days at any one island within the Monument.

f. Provide information demonstrating that you are qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

I have been conducting coral disease surveys and studies in the Monument since 2002.

I am familiar with the reefs and methodology required to safely conduct all proposed studies. I was involved in the development of protocols for investigations of coral disease developed for the Monument. I am also a co-author on the book "A coral disease handbook: guidelines for assessment, monitoring and management." and helped develop Hawaii Division of Aquatic Resources "Rapid Response Contingency Plan for unusual events of coral bleaching, disease and COTS outbreaks". Both of these publications make recommendations for proper procedures involving investigating marine diseases including field techniques, the need for follow-up laboratory investigations and safe handling of samples.

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

I am employed by the University of Hawaii and thus would be covered under University policies.

h. Explain how your methods and procedures are appropriate to achieve the proposed activity's goals in relation to their impacts to Monument cultural, natural and historic resources, qualities, and ecological integrity.

The Monuments goal is to preserve the integrity of the resources. Disease is already established in the Monument and is starting to degrade the acroporid populations. Fish disease has been documented in herbivorous fish in the Monument but there is no information on the extent of the fish populations affected. If the Momument is to prevent irreparable damage from disease it must first have information on the extent and harm from diseases. Our research addresses these needs for the Monument and does so in the most minimally invasive manner as possible. Our

methods are predominanatly visual surveys which do no harm. Marking of individual colonies is also non-invasive. Samples will be taken of any new diseases encountered not characterized by histology and surgical removal of growth anomalies will be undertanked to test the efficacy of this method for disease control. Collection of diseasd fish are required for follow-up laboragory analyses.

i. Has your vessel has been outfitted with a mobile transceiver unit approved by OLE and complies with the requirements of Presidential Proclamation 8031?

yes

j. Demonstrate that there are no other factors that would make the issuance of a permit for the activity inappropriate.

#### **8. Procedures/Methods:**

Disease surveys: As possible, re-survey of established sites at FFS, Pearl and Hermes (PHR), Midway (MID) and Kure (KUR) will be done following established protocol. Two 25 m lines will be laid out along the permanent pins. A diver will then swim over the lines during which all corals within one half meter of either side of the transect lines will be identified to specie, counted, and assigned to a size class (0-5cm; 6-10cm; 11-20cm; 21-40cm; 41-80cm; 81-150cm; >150cm.). In the same manner, a second diver will swim over the lines and examine all corals for signs of bleaching or disease. Bleached colonies will be assigned a bleaching category: 0-no bleaching; 1- 10-30%; 2-30-50%; 3-50-100%; 4- 100%; 5-mortality. For corals exhibiting disease, a general description of the condition will be recorded, the coral will be photographed and a specimen will be collected for histopathological examination. All enumerated bleached and diseased corals will also be assigned a size class consistent with the population counts. Individual colonies tagged in 2005 or 2006 will be relocated, remarked and photographed. Any new infected colonies along the transect will be photographed and tagged. Any lost pins will be replaced and any loose pins re-glued.

Acropora growth studies

Colonies of *A. cytherea* with growth anomalies and a nearest neighbor of similar size will be measured (length and width of each tier), photographed (with a ruler) and tagged. They will be re-examined the following year (2011) to look for differences in growth between affected and control colonies. We will be tagging colonies located at our established permanent sites at FFS.

#### Acropora tumor removal

Ten acropora colonies with growth anomalies and five healthy nearest neighbor colonies will be surveyed as described above. Growth anomalies will be removed from five of the colonies. GAs will be bagged at depth and processed onboard the ship for further study. This removal treatment has already been used, to a limited extent, by scientists (G. Williams) at Palmyra Atoll. Although only a few colonies were treated, it was found that growth anomaly removal was effective, there was no evidence of disease spread or that treatment adversely affect the treated colony and was effective in stopping the disease. Although, we do not know whether this disease is infective or not, if it is, removal of the GAs would also remove a potential source of infection from the reefs. In addition, to determine whether growth anomaly removal might also enhance reproduction of the colonies a small sample (5-7cm) will be collected off of all colonies (5 healthy, 5 control GA, 5 treated GA). All colonies will be re-surveyed and sampled the following year in May to determine effect of the treatment on the growth and reproduction of colonies. Surveys will also reveal whether the disease re-occurs after treatment and if so, to what extent. On the ship, GA samples will be fixed in zinc formalin for histology, gluteraldehyde for electron microscopy or bleached for skeletal analysis. Healthy coral samples will be fixed in zinc formalin for histology and polyp dissections.

#### Fish disease studies

##### Surveys

Visual surveys of populations of surgeonfish and butterflyfish will be conducted at all islands visited. Census techniques will consist of linear timed swims (using SCUBA) of 45-60 min where all acanthurids and chaetodontids with and without skin lesions or tumors will be



enumerated. Census tracks will be recorded using a float with GPS carried by one of the divers. Area surveyed will be estimated from the GPS track, and the fish census data will be used to calculate fish density (fish/unit area) and prevalence of fish with skin lesions. These same methods have been used to document prevalence of fish disease within the MHI.

#### Histology

Fish with noticeable lesions will be collected by spear, placed on ice and transported to the ship for examination. Fish will be weighed and measured (standard and fork length), examined systematically externally and internally, and gross lesions documented. For histopathology, sections of skeletal muscle, skin, spleen, liver, cranial and caudal kidneys, swim bladder, brain, heart, gill, and gonad, small intestines, and stomach will be excised and fixed in 10% neutral buffered formalin. Tissues will be sectioned, dehydrated in alcohol series, embedded in paraffin, sectioned at 5 µm, placed on microscope slides, stained with hematoxylin and eosin, and examined using a light microscope. Special stains will be used as appropriate to identify fungi, bacteria, or protozoa. Histopathology will allow us to characterize microscopic morphology of disease, will provide systematic evaluation of cellular changes that occur in disease, and will afford the opportunity to detect microorganisms and the host response to these organisms.

#### Zooplankton surveys

Zooplankton will be collected, opportunistically, at the end of each workday by doing plankton tows as we return to the ship. We will also, as possible, collect samples using light traps off of the ship in the evenings. All samples will be preserved in 10% formalin and transported back to our lab in Honolulu. Samples will be sorted and screened for parasitic infections.

**NOTE: If land or marine archeological activities are involved, contact the Monument Permit Coordinator at the address on the general application form before proceeding, as a customized application will be needed. For more information, contact the Monument office on the first page of this application.**

**9a. Collection of specimens - collecting activities (would apply to any activity): organisms or objects (List of species, if applicable, attach additional sheets if necessary):**

Common name:

table coral

Scientific name:

*Acropora cytherea*

# & size of specimens:

15 samples (5 from healthy, 5 from treated GA tables, 5 from control GA tables) size of sample: 5-7cm

Collection location:  
FFS

☐ Whole Organism ☒ Partial Organism

**9b. What will be done with the specimens after the project has ended?**

Samples will be used up in the analyses (polyp dissections)

**9c. Will the organisms be kept alive after collection?** ☒ Yes ☐ No

Samples will be kept alive until they can be fixed in zinc formalin on the ship

• General site/location for collections:

FFS

• Is it an open or closed system? ☐ Open ☒ Closed

• Is there an outfall? ☐ Yes ☒ No

• Will these organisms be housed with other organisms? If so, what are the other organisms?  
no

• Will organisms be released?  
no

**10. If applicable, how will the collected samples or specimens be transported out of the Monument?**

Transport of preserved samples out of the Monument would occur during transit between islands and back to the MHI

**11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:**

No other acroporid disease studies are currently underway in the Monument.

**12a. List all specialized gear and materials to be used in this activity:**

dive gear

coral collection gear (bone cutters, hammer, chisel, ziplock and whirlpak bags, bag to carry gear)

coral processing gear (plastic jars, z-fix, gluteraldehyde, clorox)

stereo microscope

fish dissecting gear (scissors, scalpels, forceps, scale, rulers, plastic jars, formalin)

cameras and underwater housing

sludge hammer, steel pins and underwater glue

field equipment (tape measures, floats, clipboards, underwater paper, cow ear tags, cable ties)

hand held GPS

computer

5 gal buckets with lids

plankton net

zooplankton light trap

Miscellaneous office supplies (books, tablets, pencils, pens, markers, scissors, stapler, 3-hole punch, etc.)

Personal gear (clothing, personal hygiene items, diet coke, snacks, sunglasses, etc)

**12b. List all Hazardous Materials you propose to take to and use within the Monument:**

Clorox- Sodium Hypochlorite- irritant-5 gallons-used for sterilization of equipment and growth anomaly processing for skeletal analyses.

Z-fix-zinc formaldehyde-irritant-1gallon-used for preserving coral samples for histology

Ethanol-ethyl alcohol-flammable-1 gallon-used for preserving samples for molecular analyses

Gluteraldehyde-corrosive-1 gallon-used for preserving coral samples for electron microscopy

Formaldehyde-irritant-1 gallon- used for preserving fish samples for histology

All chemicals will be contained in bottles within secondary containment and will be transported out of the Monument and sent back to our lab in Honolulu

**13. Describe any fixed installations and instrumentation proposed to be set in the Monument:**

: Repair or replacement of steel pins at permanent monitoring sites.

**14. Provide a time line for sample analysis, data analysis, write-up and publication of information:**

Fall 2010: histology, polyp dissections and parasitology processing. Spring -Fall 2011: data analysis and report writing

**15. List all Applicants' publications directly related to the proposed project:**

Aeby, G, Work, T, Fenner, D. and E. DiDonato. 2009. Coral and crustose coralline algae disease on the reefs of American Samoa. Proc Int. 11th Int. Coral Reef 197-201

Work, T., Aeby, G., Stanton, F., and D. Fenner. 2008. Overgrowth of fungi (endolithic hypermycosis) associated with multifocal to diffuse distinct amorphous dark discoloration of corals in the Indo-Pacific. Coral Reefs 27:663.

Work, T., Aeby, G. and S. Coles. 2008. Distribution and morphology of growth anomalies in Acropora from across the Indo-Pacific. Dis. Aquat. Org. 78(3):255-264.

Williams, G., Davy, S. and G. Aeby. 2008. Coral disease at Palmyra Atoll, a remote reef system in the Central Pacific. Coral Reefs 27:207.

Kenyon, J., Dunlap, M., Wilkinson, C. Page, K., Vroom, P and G. Aeby. 2007. Community structure of hermatypic corals at Pearl and Hermes Atoll, Northwestern Hawaiian Islands: Unique conservation challenges within the Hawaiian archipelago. Atoll Research Bulletin 549.

Kenyon, J., Wilkinson, C., Dunlap, M., Aeby, G. and C. Kryss. 2007. Community structure of hermatypic corals at Laysan and Lisianski/Neva Shoal, Northwestern Hawaiian Islands: A new layer of scientific exploration. Atoll Research Bulletin 550:

Aeby, G.S. 2007. First record of coralline lethal orange disease (CLOD) in the Northwestern Hawaiian Islands. *Coral Reefs* 26(2):385.

Aeby, G.S. 2007. Spatial and temporal patterns of infection of *Porites* trematodiasis on the reefs of Kaneohe Bay, Oahu, Hawaii. *Bull. Mar. Sci.* 80(1):209-218.

Aeby, G.S. 2006. Baseline levels of coral disease in the Northwestern Hawaiian Islands. *Atoll Research Bulletin* 543:471-488.

Domart-Coulon, J., N.Traylor-Knowles, E. Peters, D. Elbert, C. Downs, K. Price, J. Stubbs, S. McLaughlin, E. Cox, G. Aeby, P. Brown and G. Ostrander. 2006. Comprehensive characterization of skeletal tissue growth anomalies of the finger coral *Porites compressa*. *Coral Reefs* 25:531-543. Symp. 197-201.

Kenyon, J., Wilkinson, C. and G. Aeby. 2008. Community structure of hermatypic corals at Maro reef in the Northwestern Hawaiian Islands: A unique open atoll. *Atoll Research Bulletin* 558.

Work, T. and G. Aeby. 2006. Systematically describing gross lesions in corals. *Dis Aquatic Org* 70:155-160.

Kenyon, J. G. Aeby, R. Brainard, J. Chojnacki, M. Dunlap, C. Wilkinson. 2006. Mass coral bleaching on high-latitude reefs in the Hawaiian Archipelago. *Proc. 10th Int. Coral Reef Symp.* 631-643.

Kenyon, J., Vroom, P., Page, K., Dunlap, M., Wilkinson, C. and G. Aeby. 2006.

Community Structure of Hermatypic Corals at French Frigate Shoals, Northwestern Hawaiian Islands: Capacity for Resistance and Resilience to Selective Stressors. *Pac Sci* 60(2):153-175.

Maragos, J., D. Potts, G. Aeby, D. Gulko, J. Kenyon, D. Siciliano, and D. VanRavensway. 2004. The 2000-2002 Rapid Ecological Assessment of Corals in the Northwestern Hawaiian Islands, Part I: Species and Distribution. *Pacific Science* 58(2):211-230 .

Aeby, G. 2003. Corals in the genus *Porites* are susceptible to infection by a larval trematode. *Coral Reefs* 22:216.

Aeby, G.S., Kenyon, J., Maragos, J. and Potts, D. 2003. First record of mass coral bleaching in the Northwestern Hawaiian Islands. *Coral Reefs* 22:256.

#### Literature cited

Aeby, G.S. 2006a. Baseline levels of coral disease in the Northwestern Hawaiian Islands. *Atoll Research Bulletin* 543:471-488.

Aeby, G.S. 2006b. Outbreak of coral disease in the Northwestern Hawaiian Islands. *Coral Reefs* 24(3):481.

Aeby, G. S., Kenyon, J., Maragos, J. and Potts, D. 2003. First record of mass coral bleaching in the Northwestern Hawaiian Islands. *Coral Reefs* 22:256.

Aronson, R. B. and W. F. Precht. 2001. White-band disease and the changing face of Caribbean coral reefs. *Hydrobiologia*. 460: 25-38.

Barber, R., A. Hilting, and M. Hayes. 2001. The changing health of coral reefs. *Human and Ecological Risk Assessment*: 7(5):1255-1270.

Brown, B. 1997. Coral bleaching: causes and consequences. *Coral Reefs* 16:S129-S138.

Friedlander AM, Parrish JD, DeFelice RC (2002) Ecology of the introduced snapper *Lutjanus kasmira* (Forsskal) in the reef fish assemblage of a Hawaiian Bay. *J Fish Biol* 60:28-48

Green, E. and Bruckner, A. 2000. The significance of coral disease epizootiology for coral reef conservation. *Biological Conservation*. 96: 347-361.

Hoegh-Guldberg, O. 1999. Climate change, coral bleaching and the future of the world's coral reefs. *Marine Freshwater Research* 50:839-866.

Kenyon, J.C., Aeby, G., Brainard, R., Chojnacki, J., Dunlap, M. and C. Wilkinson 2006. Mass coral bleaching on high-latitude reefs in the Hawaiian Archipelago. *Proceedings of the 10th Int. Coral Reef Symposium, Okinawa*. pp. 631-643.

Peters, E. 1997. Diseases of coral reef organisms. In: Birkeland, C. (Ed.). *Life and Death of Coral Reefs*. Chapman & Hall, London, pp.114-136.

Porter, J., P. Dustan, W. Jaap, K. Patterson, V. Kosmynin, O. Meier, M. Patterson, and M. Parsons. 2001. Patterns of spread of coral disease in the Florida Keys. *Hydrobiology* 159: 1-24.

Randall JE (1987) Introduction of marine fishes to the Hawaiian Islands. *Bull Mar Sci* 41:490- 502

Richardson, L. 1998. Coral diseases: what is really known? *Trends in Ecol. Evol.* 13 (11):438-443.

Santavy, D., Peters, E. 1997. Microbial pests: Coral disease in the Western Atlantic. *Proc 8th Int Coral Reef Sym* 1:607-612.

Santavy, D., Mueller, E., Peters, E., MacLaughlin, L., Porter, J., Patterson, K. & Campbell, J. 2001. Quantitative assessment of coral diseases in the Florida Keys: strategy and methodology. *Hydrobiologia.* 460: 39-52.

Walker, H. 2001. Understanding and managing the risks to health and environment from global atmospheric change: A synthesis. *Human and Ecol Risk Assessment* 7(5):1195-1209.

Work T, Rameyer RA, Takata G, Kent M. 2003. Protozoal and epitheliocystis-like infections in the introduced blueline snapper *Lutjanus kasmira* in Hawaii. *Diseases of Aquatic Organisms* 37:59-66.



With knowledge of the penalties for false or incomplete statements, as provided by 18 U.S.C. 1001, and for perjury, as provided by 18 U.S.C. 1621, I hereby certify to the best of my abilities under penalty of perjury of that the information I have provided on this application form is true and correct. I agree that the Co-Trustees may post this application in its entirety on the Internet. I understand that the Co-Trustees will consider deleting all information that I have identified as "confidential" prior to posting the application.

---

Signature

Date

**SEND ONE SIGNED APPLICATION VIA MAIL TO THE MONUMENT OFFICE  
BELOW:**

Papahānaumokuākea Marine National Monument Permit Coordinator  
6600 Kalaniana'ole Hwy. # 300  
Honolulu, HI 96825  
FAX: (808) 397-2662

**DID YOU INCLUDE THESE?**

- ☒ Applicant CV/Resume/Biography
- ☒ Intended field Principal Investigator CV/Resume/Biography
- ☒ Electronic and Hard Copy of Application with Signature
- ☐ Statement of information you wish to be kept confidential
- ☒ Material Safety Data Sheets for Hazardous Materials

**Supplement for collection**  
**Aeby**

Common name: reef fish

Scientific name: Targeted fish species include *Lutjanus kasmira*, *Ctenochaetus strigosus*, *Acanthurus nigrofasciatus*, *Acanthurus* sp., *Mulloidichthys vanicolensis*, *M. flavolineatus*, *Parupeneus multifasciatus*, *P. pleurostigma*, and *M. pflugeri*

# & size of specimens: We will collect a maximum of 20 fish per specie per island for *Lutjanus kasmira* and the five goatfish species. For affected surgeonfish, *Ctenochaetus strigosus*, *A. nigrofasciatus* or other species with lesions, we are requesting a maximum of 10 affected and 10 healthy fish per specie per island.

Collection location: shallow water reefs throughout Monument  
x Whole Organism Partial Organism

**1b. What will be done with the specimens after the project has ended?** The fixed samples will be transported to Oahu for parasitological and histopathological analysis.

**1c. Will the organisms be kept alive after collection?** Yes x No

- Specific site/location:
- Is it an open or closed system? ☐ Open X Closed
- Is there an outfall? ☐ Yes XNo
- Will these organisms be housed with other organisms? If so, what are the other organisms? no
- Will organisms be released? no

**2. If applicable, how will the collected samples or specimens be transported out of the Monument?** Samples will be transported on ice on small boats to the Hi'ialakai which may or may not be within Monument waters. Fixed samples will be transported back to Honolulu via the Hi'ialakai.

**3. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:** Fish samples will be collected by and shared with Brian Bowen's group and so they will also be used for both molecular and life history studies.

Common name: reef coral

Scientific name: *Porites* sp., *Montipora* sp., *Pocillopora* sp., *Pavona* sp. Species will vary depending upon disease occurrence.

# & size of specimens: We will only collect samples of diseased corals that have not already been characterized by histology. We anticipate a maximum of 30 samples (all islands combined) to be collected if new diseases are encountered. Sample size would be 2-5 cm each. 2 samples would be taken per colony (one from the diseased region and one from the healthy region).

Collection location: shallow water reefs within the Monument  
Whole Organism ☒ Partial Organism

**1b. What will be done with the specimens after the project has ended?** Fixed samples will be transported to Oahu for histopathological analyses.

**1c. Will the organisms be kept alive after collection?** Yes ☒ No  
However, please note that corals will be transported live in buckets of sea water to the Hi'ialakai where they will be placed in Z-fix.

- Specific site/location:
- Is it an open or closed system? ☐ Open ☒ Closed
- Is there an outfall? ☐ Yes ☒ No
- Will these organisms be housed with other organisms? If so, what are the other organisms? No
- Will organisms be released? No

**2. If applicable, how will the collected samples or specimens be transported out of the Monument?** Samples will be transported in buckets on small boats to the Hi'ialakai which may or may not be within Monument waters. Fixed samples will be transported back to Honolulu via the Hi'ialakai.

**3. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:** none

Common name: Zooplankton

Scientific name: Will vary by sample

# & size of specimens: 100s-1000s of zooplankton  
Collection location: shallow water reefs throughout Monument  
☒ Whole Organism ☐ Partial Organism

**1b. What will be done with the specimens after the project has ended?** The fixed samples will be transported to Oahu for parasitological analysis.

**1c. Will the organisms be kept alive after collection? Yes ☒ No**

- Specific site/location:

- Is it an open or closed system? ☐ Open ☒ Closed

- Is there an outfall? ☐ Yes ☒ No

- Will these organisms be housed with other organisms? If so, what are the other organisms? no

- Will organisms be released? no

**2. If applicable, how will the collected samples or specimens be transported out of the Monument?** Samples will be transported in buckets on small boats to the Hi'ialakai which may or may not be within Monument waters. Fixed samples will be transported back to Honolulu via the Hi'ialakai.

**3. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:** no other zooplankton studies are currently underway in the Monument

## Papahānaumokuākea Marine National Monument Compliance Information Sheet

**1. Updated list of personnel to be covered by permit. List all personnel names and their roles here (e.g. John Doe, Diver; Jane Doe, Field Technician, Jerry Doe, Medical Assistant):** Greta Aeby, HIMB; Dr. Fenny Cox, UH West Oahu; Dr. Frank Stanton, LCC

**2. Specific Site Location(s): (Attach copies of specific collection locations):**  
 Permanent sites for coral disease surveys:

island	site	depth(ft)	habitat	lat	long
ffs	r11b	67	lagoon	23 38.149	166 11.138
ffs	tc12	30	lagoon	23 38.323	166 10.802
ffs	tc21	25	forereef	23 50.822	166 19.630
ffs	r16	24	shelf	23 51.049	166 19.759
ffs	tc30	14	lagoon	23 50.988	166 17.840
ffs	rap	80	patch	23 38.10	166 11.12
PHR	jm10	3	backreef	27 50.072	175 45.210
PHR	tc31	19	backreef	27 46.532	175 58.401
PHR	tc32	21	backreef	27 46.351	175 56.370
PHR	tc26	5	backreef	27 57.468	175 48.125
PHR	r44	46	backreef	27 54.631	175 54.280
mid	tc1	3	backreef	28 16.148	177 23.181
mid	jm20	3	backreef	28 16.288	177 23.167
mid	r23	3	backreef	28 16.436	177 21.048
mid	r15	3	backreef	28 16.672	177 21.831
Kur	r36	15	backreef	28 25.198	178 22.345
Kur	tc17	12	backreef	28 25.912	178 22.003
Kur	tc13	3	backreef	28 27.147	178 18.915
Kur	tc14	3	backreef	28 27.209	178 19.716

**3. Other permits (list and attach documentation of all other related Federal or State permits):**

prior permits: FWS permit #'s: 12521-04020, 12521-05017, 12521-05056, 12521-06028;  
NWHICRER permit #'s: 2005-001, 2005-013; DAR permit #'s: 2004-10, 2005-11, 2006-06, 06R008

**3a. For each of the permits listed, identify any permit violations or any permit that was suspended, amended, modified or revoked for cause. Explain the circumstances surrounding the violation or permit suspension, amendment, modification or revocation.** I was found in violation of DAR permit # 2006-06 for having an experiment in progress when the chief scientist decided to change the itinerary and move the ship from FFS to Gardner. This decision by the chief scientist resulted in my experimental corals onboard the ship being 'transported' out of state waters and so I was found in violation.

**4. Funding sources (Attach copies of your budget, specific to proposed activities under this permit and include funding sources. See instructions for more information):** The project will be funded by the PMNM-HIMB partnership NMSP0 MOU 2010-008/66882.

**5. Time frame:**

Activity start: May 10, 2010

Activity completion: June 3, 2010

Dates actively inside the Monument:

From: May 13, 2010

To: June 2, 2010

Describe any limiting factors in declaring specific dates of the proposed activity at the time of application:

Availability of the Hiialakai.

Personnel schedule in the Monument:

**6. Indicate (with attached documentation) what insurance policies, bonding coverage, and/or financial resources are in place to pay for or reimburse the Monument trustees for the necessary search and rescue, evacuation, and/or removal of any or all persons covered by the permit from the Monument:**

**7. Check the appropriate box to indicate how personnel will enter the Monument:**

X ☐ Vessel  
☐ Aircraft

Provide Vessel and Aircraft information:

**8. The certifications/inspections (below) must be completed prior to departure for vessels (and associated tenders) entering the Monument. Fill in scheduled date (attach documentation):**

☐ Rodent free, Date:  
☐ Tender vessel, Date:  
☐ Ballast water, Date:  
☐ Gear/equipment, Date:  
☐ Hull inspection, Date:

**9. Vessel information (NOTE: if you are traveling aboard a National Oceanic and Atmospheric Administration vessel, skip this question):**

Vessel name:

Vessel owner:

Captain's name:

IMO#:

Vessel ID#:

Flag:

Vessel type:

Call sign:

Embarkation port:

Last port vessel will have been at prior to this embarkation:

Length:

Gross tonnage:

Total ballast water capacity volume (m3):

Total number of ballast water tanks on ship:

Total fuel capacity:

Total number of fuel tanks on ship:

Marine Sanitation Device:

Type:

Explain in detail how you will comply with the regulations regarding discharge in the Monument. Describe in detail. If applicable, attach schematics of the vessel's discharge and treatment systems:

Other fuel/hazardous materials to be carried on board and amounts:

Provide proof of a National Oceanic and Atmospheric Administration (NOAA) Office of Law Enforcement-approved Vessel Monitoring System (VMS). Provide the name and contact information of the contractor responsible for installing the VMS system. Also describe VMS unit name and type:

VMS Email:

Inmarsat ID#:

**10. Tender information:**

On what workboats (tenders) will personnel, gear and materials be transported within the Monument? List the number of tenders/skiffs aboard and specific types of motors:

**Additional Information for Land Based Operations**

**11. Proposed movement of personnel, gear, materials, and, if applicable, samples:**

**12. Room and board requirements on island:**

**13. Work space needs:**

**DID YOU INCLUDE THESE?**

- ☐ Map(s) or GPS point(s) of Project Location(s), if applicable
- ☐ Funding Proposal(s)
- ☐ Funding and Award Documentation, if already received
- ☐ Documentation of Insurance, if already received
- ☐ Documentation of Inspections
- ☐ Documentation of all required Federal and State Permits or applications for permits